OPERATING MANUAL

MODEL 124
DROP AND INSERT

Telecommunications
Techniques
Corporation

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MODEL 124 DROP AND INSERT OPERATING MANUAL

AUGUST 1987

Telecommunications
Techniques
Corporation

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SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

This operating manual contains information on the physical and functional features, operation, and specifications of Telecommunications Techniques Corporation's Model 124 Drop and Insert instrument.

1.2 INSTRUMENT OVERVIEW

The Model 124 Drop and Insert is a test set accessory that allows monitoring and testing of any 1 of the 24 voice or data channels present in a DS1 signal. The Model 124 Drop and Insert offers the versatility to be used with a variety of bit-error rate test sets, VF test sets, or protocol analyzers.

The Model 124 is equipped with an integral DS0 bipolar interface which is compatible with KS-type test sets and FIREBERD Data Error Analyzers. The optional 4-Wire VF Interface Module allows monitoring of voice circuits on an internal loudspeaker and VF test access through an optional VF 600-ohm interface. The optional DSU Data Port Interface provides the functions of a Data Service Unit (DSU) by converting channelized DDS DS0A-formatted data into serial data streams in either V.35 or RS-232 formats at data rates of 2.4 kb/s, 4.8 kb/s, 9.6 kb/s, 56 kb/s, or 64 kb/s.

The Model 124 is divided into a Drop Side and an Insert Side (see Figure 1-1). Both functions share a set of common controls that allow selection of the DS1 format (D1D, D2, D3/D4, ESF, or SLC*-96) and the DSU Data Port's data rate, as well as provide indicators for bit and frame slips.

The Drop Side permits the user to select any 1 of 24 DS1 channels, simultaneously decode the channel as DS0-formatted information, front-panel indicator displays (received byte and VF signaling bit indicators), VF information (VF Option) and DDS-encoded data (DSU Data Port Option). The selected channel information can then be sent to a bit-error rate test set, VF test set, or protocol analyzer.

The Insert Side allows the user to insert new data in one, all, or none of the 24 DS1 channels before passing the data to the DS1 output. The new data to be inserted may be selected from:

- a programmable, 8-bit data byte.
- data from the DS0 Interface.

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*SLC is a registered trademark of AT&T Technologies.

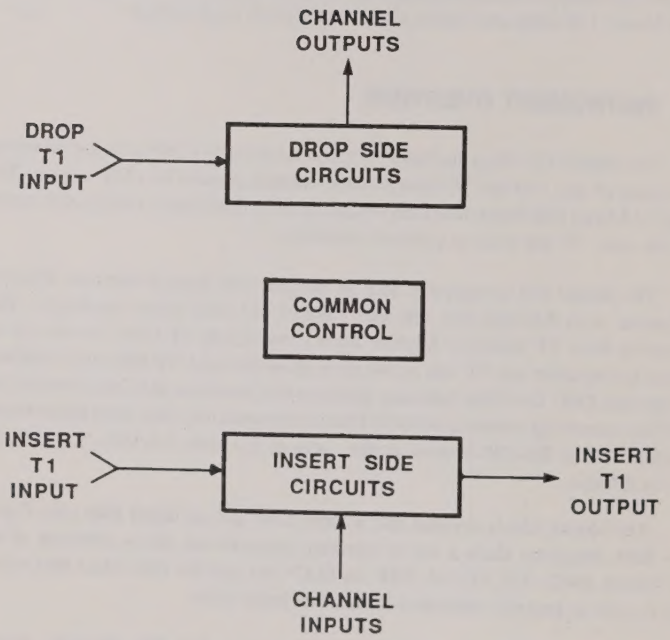

Figure 2-1
Model 124 Block Diagram

- a digitally-encoded, 1004 Hz 0dBm0 sine wave suitable for VF testing.
- an external VF signal input with control of signaling bits (A and B, for D format; A,B, C, and D for ESF format).
- an external VF signal with signaling bits passed through unaffected.
- data at 2.4 kb/s, 4.8 kb/s, 9.6 kb/s, 56 kb/s, or 64 kb/s via the DSU Data Port Option.

The Model 124's Insert circuitry is transparent to both ESF and SLC-96 data links allowing testing between the Central Office Terminal (COT) and the Remote Terminal (RT) without service interruption.

The Model 124 front panel features three LED displays and a combination of electronic slide switches and discrete pushbutton switches, some of which contain LED indicators. The front panel also contains alarm, received byte, and signaling indicators. The rear panel features various input and output connectors, DIP switches, test points, an AC receptacle, and the power switch. The Model 124 is packaged in a rugged, aluminum case weighing only 8.25 pounds, making it easily portable. The Model 124 may also be rack-mounted.

SECTION 2
INSTRUMENT DESCRIPTION

2.1 INTRODUCTION

This section begins with a brief functional description of the Model 124, followed by descriptions of its front-panel switches, indicators, and displays. It also describes the connectors and test points on the rear panel and other pertinent features.

2.2 FUNCTIONAL DESCRIPTION

The Model 124 is divided into two functional halves, Insert and Drop, with some common circuitry. Figure 2-1 is a block diagram of the Model 124's internal architecture. The Insert circuitry is located in the upper half of the diagram and will be described from left to right. A DS1 signal connected to the INSERT T1 INPUT is sent to the INSERT T1 RCVR. The signal is then decoded and stripped of framing by the DECODER + FRAME SYNC block. This block also detects any alarm condition present in the DS1 signal. The CHANNEL INSERT circuitry determines which channels are routed to the FRAMING + ENCODING circuitry from the DECODER + FRAME SYNC block and which channels are routed from the SOURCE SELECT blocks. In turn, the SOURCE SELECT block determines which circuit will be the source of data to be inserted into the selected channel. The FRAMING + ENCODING circuitry adds framing and line coding as designated by the AMI/B8ZS switch. The signal is then sent through the T1 DRIVER to the INSERT T1 OUTPUT connector.

The lower half of Figure 2-1 contains the Drop circuitry. The DS1 signal is routed from the DROP T1 INPUT to the DROP T1 RCVR and then to the DECODER + FRAME SYNC block, which functions identically to the Insert circuitry. The signal is then sent to the CHANNEL SELECT circuitry, which latches the channel that is selected by the DROP CHANNEL SELECT switch and sends it to all of the output circuits simultaneously.

An internal T1 source is connected to the INSERT T1 INPUT if no input signal is detected. When no signal is detected at the DROP T1 INPUT, the signal is routed from the INSERT T1 INPUT.

The output from both T1 receivers is sent to the SLIPS DETECTOR, which compares the clocks recovered by the INSERT and DROP T1 RCVRs to determine if they are synchronized or are slipping.

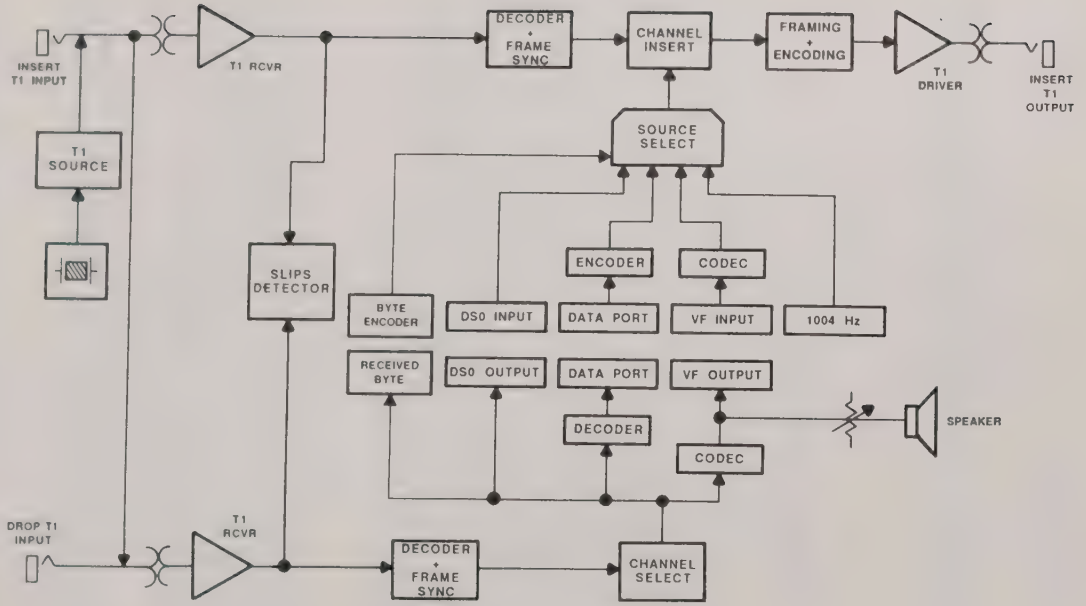

Figure 1-1
Top Level Diagram

2.3 FRONT PANEL

The Model 124 has most of its switches and all of its indicators on the front panel. The front panel is divided into three areas: the Insert Side, Common Controls, and the Drop Side. Descriptions of these three areas as well as their applicable switches, indicators, and displays are contained in the following sections.

The Model 124 features two types of switches: (1) single-function pushbutton switches, some of which contain LED indicators; and (2) electronic slide switches, which consist of a column of labeled indicators above a corresponding pushbutton switch. Pressing and releasing the corresponding pushbutton switch turns off the illuminated indicator and turns on the next indicator. When the switch is pressed and held down, the sequence continues until the switch is released.

Figure 2-2 is a photograph of the Model 124's front panel. The numbers preceding the switch and indicator descriptions correspond to the numbers in the figure.

2.3.1 Insert Side

The Model 124 allows data or digitally encoded VF information to replace the data in any or all of the channels of a DS1 data stream. It can connect at nearly any T1 access point; the user can select the correct T1 receiver impedance and signal compensation. An internally generated DS1 signal with an idle channel code (0111 1111) in each of the 24 channels is available when a signal is not present at the Insert Side T1 input. Multiple sources of data can be inserted using the SOURCE SELECT switch. Signaling information can also be inserted into the signaling frames of the selected channel(s) when either the 1004 Hz signal source or VF signal source is selected. The inserted signaling information is controlled either through the front panel or through the optional 4-Wire VF Interface. Once data and signaling information has been inserted into the selected channel(s), the DS1 signal is transmitted using alternate mark inversion (AMI) or bipolar with eight zero substitution (B8ZS) encoding. The encoding selection has no effect on either the Insert or Drop Side receiver, since each will accept AMI or B8ZS encoded data regardless of the selection. When the Model 124 is not powered, a relay closure completes the signal path between the Insert Side input and output. This prevents the T1 span from being interrupted during power losses.

The following list describes in detail the Insert Side's switches, displays, and indicators.

1. CHANNEL SELECT Switch/Display

The two-position CHANNEL SELECT switch allows the insertion of the desired signal source to any 1, all, or none of the 24 channels in the outgoing DS1 signal. The display immediately above the CHANNEL SELECT switch shows the chan-

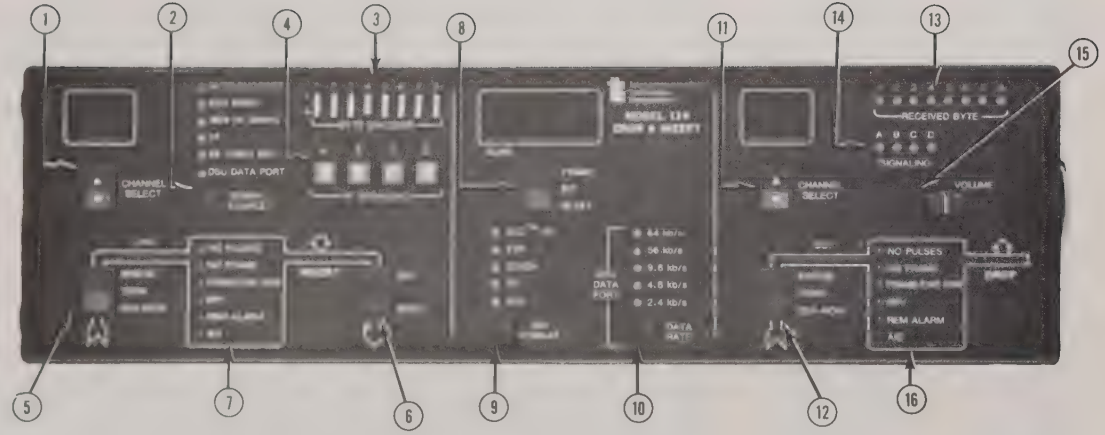

Figure 2-2
Model 124 Front Panel

nel(s) selected. The initial channel selection at power-up is none; this selection is represented by two dashes "--". The switch allows the user to increment or decrement the channel appearing in the display from none ("--") through ALL, with the numbers 1 through 24 in between. Holding down the switch for longer than 1 second causes the channel selections to be scrolled automatically into the display. Releasing the switch selects the channel that appears in the display; this selection will flash for 3 seconds until the hardware is activated. This provides hit-free operation; that is, other channels are not interrupted during channel selection.

2. SIGNAL SOURCE Switch

The SIGNAL SOURCE pushbutton switch selects any one of six possible signal sources described below. Note that the indicators labeled VF, VF (THRU SIG), and DSU DATA PORT will not be illuminated and cannot be selected unless the corresponding optional interface is installed. The following definitions describe each signal source selection.

BYTE ENCODER	This selection allows the user to specify an 8-bit pattern, which will be repetitively inserted into the selected channel(s). The particular 8-bit pattern is determined by the position of the BYTE ENCODER switches.
DS0 INPUT	This selection allows the insertion of DS0 data from the integral 64 kb/s DS0 Interface.
1004 Hz 0dBm0	This selection allows the insertion of a digitally encoded 1004 Hz 0dBm0 sine wave suitable for VF testing. The signaling bits are under user control.
VF	This selection allows the insertion of VF signals from the optional 4-Wire VF Interface while retaining user control of the signaling bits.
VF (THRU SIG)	This selection allows the insertion of VF signals from the optional 4-Wire VF Interface, while signaling bits are passed through from the original channel(s) unchanged.
DSU DATA PORT	This selection allows the insertion of data from the optional DSU Data Port Interface at various data rates: 2.4, 4.8, 9.6, 56, and 64 kb/s. The particular rate is set using the DATA RATE pushbutton switch in the Common Controls area of the Model 124 front panel

NOTE: For 1004 Hz and VF signal sources, the signaling information is determined either by the VF SIGNALING switches on the front panel or by signals connected to the 15-pin D connector of the optional 4-Wire VF Interface installed in the rear panel. Signaling bit control is provided for A and B bits when D1D, D2, or D3/D4 framing formats are selected or for A, B, C, and D bits when the ESF framing format is selected.

3. BYTE ENCODER Switches

These eight switches are used in conjunction with the BYTE ENCODER position of the SIGNAL SOURCE switch to define a specific bit pattern or a single byte which will be repetitively inserted into the selected channel(s). The 1 (up) and 0 (down) positions are labeled to the left of the switches.

4. VF SIGNALING Switches

The group of four VF SIGNALING switches—labeled A, B, C, and D—allow the user to set the desired signaling state from the front panel. LEDs inside the switches are illuminated to indicate that a "1", or extinguished to indicate that a "0", is being inserted into the signaling bit position. The LEDs inside the switches will indicate the insert signaling status even when the signaling sources are not the front-panel switches, such as when Pin 13 is grounded on the optional 4-Wire VF Interface allowing it to be the signaling source. The LEDs also indicate the signaling status when the VF (THRU SIG) position of the SIGNAL SOURCE switch is selected. Note that signaling is not controlled whenever the none ("--") or ALL positions of the CHANNEL SELECT switch are selected or when SLC-96 framing is selected. The C and D switches are provided for ESF framing.

5. BRIDGE/TERM/DSX-MON Switch

This three-position switch selects the T1 receiver's input impedance and signal conditioning. The BRIDGE and TERM positions provide high impedance and 100-ohm input impedance, respectively. Both positions will compensate the signal for up to 24 dB of cable loss. The DSX-MON position provides both a 100-ohm input impedance and amplification of the input signal, which compensates for resistively attenuated signals found at DSX monitor jacks.

6. AMI/B8ZS Switch

This two-position switch determines the line coding format of transmitted T1 data: alternate mark inversion (AMI) code or bipolar with eight zero substitution (B8ZS) clear channel code. The position of this switch has no effect on the receiver, which automatically configures itself to accept either AMI or B8ZS line codes.

7. Alarm Indicators

There are six alarm indicators on the Insert Side of the Model 124 front panel. The indicators are illuminated when certain conditions are detected in the incoming DS1 signal. The following list provides a description of each indicator.

NO PULSES	This indicator will be illuminated when no signal is detected for 150 ms or more.
NO FRAME	This indicator will be illuminated when the Model 124 is unable to achieve frame synchronization.
FRAME/CRC ERR	This indicator will be illuminated when either a framing bit error (D1D, D2, D3/D4, or SLC-96) or a CRC error (ESF) is detected.

BPV	This indicator will be illuminated when a bipolar violation is detected. Note that B8ZS codes will not cause this indicator to be illuminated.
REM ALARM	This indicator will be illuminated when a yellow alarm signal is detected. A yellow alarm is declared when: (1) for D1D, D2, D3, D4, and SLC-96, bit 2 of each channel is a "0" for 255 consecutive channels; or (2) for ESF, 256 bits ± 16 bits of a repetitive "1111 1111 0000 0000" pattern is detected in the 4 kb/s data link.
AIS	This indicator will be illuminated when an Alarm Indication Signal (2048 or more consecutive ones) is detected.

2.3.2 Common Controls

The center section of the Model 124's front panel contains controls which are common to the operation of both the Insert Side and the Drop Side. These controls enable the user to select the framing format, test for frame and bit slips, and select data rates for the optional DSU Data Port Interface.

Framing format selections include D1D, D2, D3/D4, ESF, and SLC-96 formats. When either the ESF or SLC-96 format is selected, the Model 124's circuitry does not overwrite the data in the "data link" portion of the framing sequence. This feature allows the Model 124 to be used in applications where data link integrity must be maintained, such as between SLC Series 5 or SLC-96 channel banks.

The SLIPS feature allows the user to determine if DS1 signals are synchronized. This may be useful, for example, in determining whether the channel banks under test are loop-timed. The SLIPS display shows the amount of slippage between the clock recovered from the Drop Side T1 input and the clock recovered from the Insert Side T1 input. Either bit slips or frame slips may be shown in the display. The bit slips result can both increment and decrement, allowing measurements on systems with low-speed wander. The frame slips result count will only increment, showing the number of times that a 1-frame, elastic-store buffer would have to recenter during the test period. The frame slips result corresponds to the number of impairments (hits) that would occur as a result of non-synchronized T1 clock sources being used in transmission systems with Digital Access and Crossconnect Switches (DACS) or similar equipment which contains elastic-store buffers.

The following list describes in detail the common controls.

8. FRAME/BIT/RESET Switch and SLIPS Display

This three-position switch is used to select either the bit slips or frame slips result to appear in the SLIPS display. The BIT result increments or decrements one count

for each slipped bit period over a range of ±192 bits. The FRAME result shows a count of frame slips; the count increments whenever the bits slips count exceeds ±192 bits. The momentary RESET position clears both the frame slips and bit slips count. The SLIPS display will flash when the frame slips count has overflowed (after 9999 frame slips), or when a signal loss is detected at either the Drop Side or Insert Side T1 input.

9. DS1 FORMAT Switch

The DS1 FORMAT switch allows the selection of D1D, D2, D3/D4, ESF, or SLC-96 framing formats. The format selected with this switch affects both the Insert Side and the Drop Side.

10. DSU DATA PORT DATA RATE Switch

When the optional DSU Data Port Interface is installed, the DATA RATE switch is used to set the synchronous data rate for both the Insert and Drop Sides at 2.4, 4.8, 9.6, 56, or 64 kb/s. The four lower data rates are used in DDS DS0A encoded data. The dropped data is always available at both the RS-232 and V.35 connectors regardless of the signal source selected with the Insert Side SIGNAL SOURCE switch.

2.3.3 Drop Side

The controls on the Drop Side of the Model 124 allow any 1 of 24 channels to be dropped out of the incoming DS1 signal and monitored. The channel selected on the Drop Side is simultaneously routed to all drop circuits, which include the DS0 interface, the RECEIVED BYTE indicators, and the optional VF Interface and DSU Data Port Interface. Controls identical to those on the Insert Side allow the user to set the correct impedances and signal compensation for nearly any T1 access point. The alarm indicators on the Drop Side are illuminated under the same conditions as those on the Insert Side.

When a DS1 signal is not detected at the Drop Side input, the Model 124 will automatically route the Insert Side DS1 input signal to the drop circuits. However, when this occurs the NO PULSES and NO FRAME indicators on the Drop Side will remain illuminated to indicate the absence of a signal at the Drop Side T1 input.

The following list describes in detail the Drop Side's switches, displays, and indicators.

11. CHANNEL SELECT Switch/Display

The two-position CHANNEL SELECT switch allows the selection of 1 of 24 channels to be dropped out of the incoming DS1 signal. The switch enables the user to increment or decrement the channel number appearing in the display from 1 through 24. Holding down the switch for longer than 1 second causes the channel selections to be scrolled automatically into the display. Releasing the switch selects the channel that appears in the display.

12. BRIDGE/TERM/DSX-MON Switch

This switch operates identically to the BRIDGE/TERM/DSX-MON switch on the Insert Side.

13. RECEIVED BYTE Indicators

These eight indicators are illuminated to reflect, in real time, the data bit status of the selected channel on the Drop Side. This is useful in determining if the correct idle code or loop code is being received.

14. SIGNALING Indicators

These four indicators—labeled A, B, C, and D—are illuminated to reflect the signaling bit status of the selected channel on the Drop Side. The A and B indicators are functional when D1D, D2, or D3/D4 framing format is selected; none of the indicators are functional when SLC-96 format is selected. The A, B, C, and D indicators can be illuminated when ESF framing is selected.

15. VF Interface Speaker and VOLUME Control

The speaker output allows monitoring of VF channels for voice or tone when the optional VF Interface is installed. The sliding VOLUME switch adjusts the volume of the voice or tone.

16. Alarm Indicators

These six alarm indicators are illuminated when certain conditions are detected in the incoming DS1 signal. The specific conditions under which the indicators are illuminated are identical to those described for the Insert Side alarm indicators.

2.4 REAR PANEL

All connections to the Model 124 are made on the rear panel; optional interface modules are also installed in slots on the rear panel. In addition, the rear panel features the power switch, various test points, and eight DIP switches. Figure 2-3 is a photograph of the Model 124 rear panel; the numbers preceding the following connector and switch descriptions correspond to the numbers in the figure.

1. Power Switch

The power switch is located to the left of the AC receptacle and fuse holder. The switch is marked with a "1" and a "0". The 1 position applies power to the instrument; the 0 position removes power.

2. Fuse

The fuse holder is located immediately to the left of the AC receptacle. The Model 124 should be operated with a 500 mA, 250V, fast-acting fuse (Littlefuse #217.500 or equivalent). See Section 7.2.2 for fuse replacement instructions.

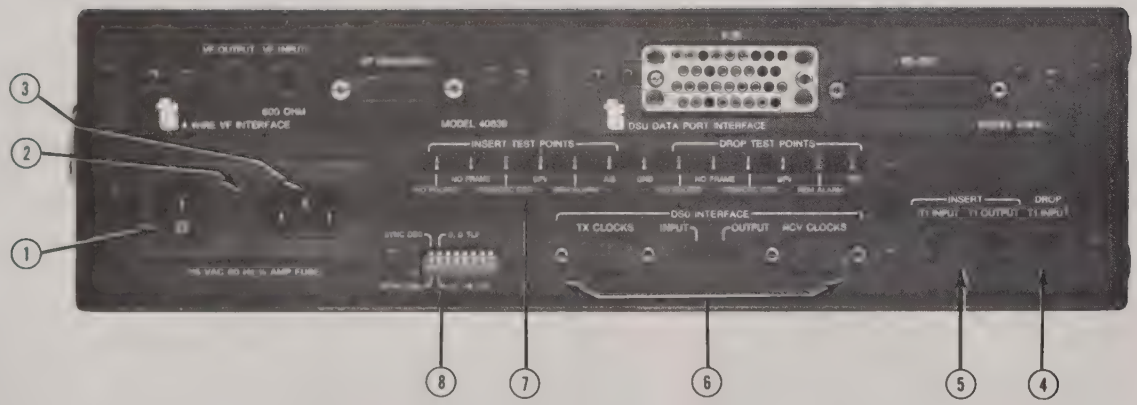

Figure 2-3
Model 124 Rear Panel

3. AC Receptacle

The AC receptacle, located to the right of the power switch and fuse, accepts a power cord with a standard 3-pin female connector. The center pin of the connector is connected to chassis ground. The other two pins carry the AC input current.

4. DROP T1 INPUT

This WECO 310 jack allows connection of the incoming DS1 signal for the Drop Side functions.

5. INSERT T1 INPUT/OUTPUT

These WECO 310 jacks allow connection of both incoming and outgoing Insert Side DS1 signals. The INSERT T1 OUTPUT provides a signal at the DSX cross-connect level which meets all applicable specifications for pulse shape. A relay will connect the INSERT T1 INPUT to the INSERT T1 OUTPUT whenever power is lost to prevent service interruption.

6. DS0 INTERFACE

The DS0 interface is permanently installed and provides the electrical interface to allow access to DS0-encoded data at any T1 presence. Two bantam jacks are provided: one for connecting a DS0 signal source for the Insert Side, and one for providing a DS0 output signal from the Drop Side DS1 signal.

Clock connections are made via two 9-pin D connectors, one each for transmit and receive clocks. The 64 kH/z bit and 8 kH/z byte clock are available in both differential and TTL signal formats at the connectors.

DIP Switch 1 on the rear panel determines whether the two clock connectors contain identically phased clocks (SYNC DS0 position) or clocks individually synchronized to its respective T1 frame rate (ASYNC DS0 position). The SYNC DS0 position is used in most instances allowing a single clock connection for both DS0 input and output data. However, should the T1 signals be slipping, as indicated by the SLIPS display, the ASYNC DS0 position must be used.

7. INSERT TEST POINTS/DROP TEST POINTS

There are 13 test points located on the rear panel; the test points are split into an Insert group and a Drop group and have a one-to-one correspondence to the front panel Insert Side and Drop Side alarm indicators. The test points can be used for triggering external equipment when an alarm condition occurs. A logic low at the test point indicates the presence of an alarm condition; the specific alarm conditions are listed below. The center test point is connected to signal ground.

NO PULSES	This test point will be a logic low when no signal is detected for 150 ms or more.
NO FRAME	This test point will be a logic low when the Model 124 is unable to achieve frame synchronization.

FRAME/CRC ERR	This test point will be a logic low when either a framing bit error (D1D, D2, D3/D4, or SLC-96) or a CRC error (ESF) is detected.
BPV	This test point will be a logic low when a bipolar violation is detected. Note that B8ZS codes will not cause this indicator to illuminate.
REM ALARM	This test point will be a logic low when a yellow alarm signal is detected. A yellow alarm is declared when: (1) for D1D, D2, D3, D4, and SLC-96, bit 2 of each channel is a "0" for 255 consecutive channels; or (2) for ESF, 256 bits ± 16 bits of a repetitive "1111 1111 0000 0000" pattern is detected in the 4 kb/s data link.
AIS	This test point will be a logic low when an Alarm Indication Signal (2048 or more consecutive ones) is detected.

8. DIP Switches

There are eight DIP switches on the rear panel. Two of the switches are described below; the remaining six switches are provided to allow expansion of capabilities.

DIP Switch 1 (SYNC/ASYNC DS0)	This switch controls the operating mode of the DS0 interface. The SYNC (up) and ASYNC (down) positions select the synchronous (or slave) mode or the asynchronous mode.
DIP Switch 2 (0,0 TLP/+7,-16 TLP)	This switch controls the Transmission Level Point (TLP) of the optional VF Interface. In the 0,0 TLP (up) position, 0 dBm0 is defined as 0 dBm. In the +7, -16 TLP (down) position, 0 dBm0 is defined as +7 dBm for the Drop Side VF output and a -16 dBm for the Insert Side VF input.

SECTION 3
PREPARATION FOR USE

3.1 INTRODUCTION

This section provides information on preparing the Model 124 for use. Specifically included are instructions for unpacking and inspecting the instrument; a list of the equipment that should be contained in the shipment; warnings and power requirements; instructions for moving the ground jumper; and an instrument checkout procedure.

3.2 UNPACKING AND INITIAL INSPECTION

The Model 124's shipping container should be inspected for damage when it is received. If the shipping container or shipping material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are given in Section 3.6. If the contents are incomplete, if there is mechanical damage or defect, or if the Model 124 does not pass the performance tests, the customer should notify TTC. If the shipping container is damaged, notify the carrier as well as TTC, and keep the shipping container and materials for the carrier's inspection.

3.3 EQUIPMENT INCLUDED

The following equipment is supplied with each unit:

(1) Model 124 Drop and Insert Instrument
(2) AC Line Cord
(3) Operating Manual

3.4 POWER REQUIREMENTS

The Model 124 requires an uninterrupted source of 115 VAC, 60 Hz power. Power is supplied to the Model 124 through the AC line cord supplied with the instrument. The Model 124 should be operated with a 500 mA, 250V, fast-acting fuse (Littlefuse #217.500 or equivalent) installed.

3.5 GROUND JUMPER

The Model 124 is equipped with a pluggable ground jumper. When the Model 124 is shipped from the factory, signal ground is connected to chassis ground through a 150-ohm, 1/2 watt resistor. Signal ground may be directly connected to chassis ground by repositioning the pluggable jumper on the PC board.

To reposition the jumper, use the following procedure.

(1) Remove the power cord from the back of the Model 124.
(2) Using a Phillips screwdriver, remove the four screws (two on each side) from the top cover and lift the cover off of the unit.
(3) Do not remove any interface modules
(4) Remove the six screws indicated in Figure 3-1 on the rear panel. As shown in Figure 3-2, place your thumbs on the topboard assembly and slide it back about 4 inches, being careful not to damage the wires from the AC connector. Note that the top PC board and any optional interface will also pull backward.
(5) On the lower PC board, locate jumper JW2 near the large power transformer.
(6) Facing the Model 124 from the front, remove the pluggable jumper that connects the post labeled 150 to the center post of JW2.
(7) Connect the pluggable jumper from the center post to the post labeled 0. Signal ground is now directly connected to chassis ground.
(8) To reassemble the Model 124, slide the top PC board back and place the rear panel back into position. Replace the six screws that secure the rear panel.
(9) Place the top cover back on the unit and insert the four screws which hold it in place.

3.6 INSTRUMENT CHECKOUT

3.6.1 Automatic Self-Test

The automatic self-test is actually a series of diagnostic tests that are performed at power-up by the Model 124 to ensure that it is functioning correctly.

The automatic self-test performs the following functions:

- All of the indicators and the displays are illuminated for approximately 1 second at power-up.
- Random Access Memory (RAM) and Read Only Memory (ROM) are checked at power-up. If one or both of these tests fail, the Model 124 will display an error message in the SLIPS display; TTC should be called for service.

3.6.2 Manual Self-Test

As recommended in Section 3.2, the Model 124 should be checked mechanically and electrically upon unpacking. The manual self-test in this section covers power-up and DS1 operation; Appendix A contains more detailed procedures for

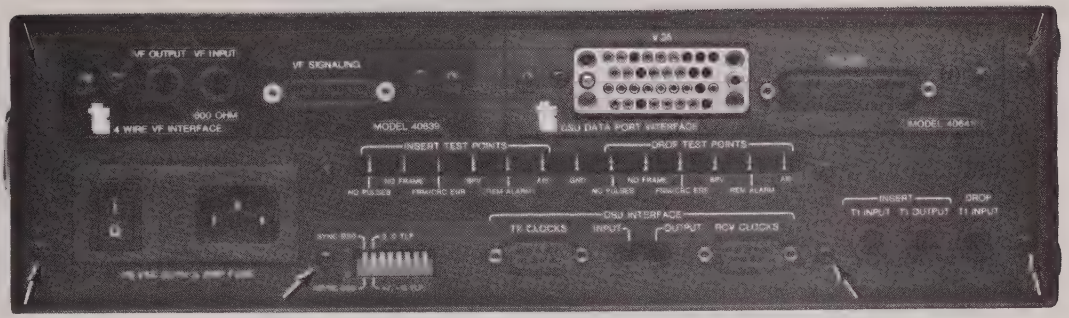

Figure 3-1
Model 124 Rear-Panel Screw Locations

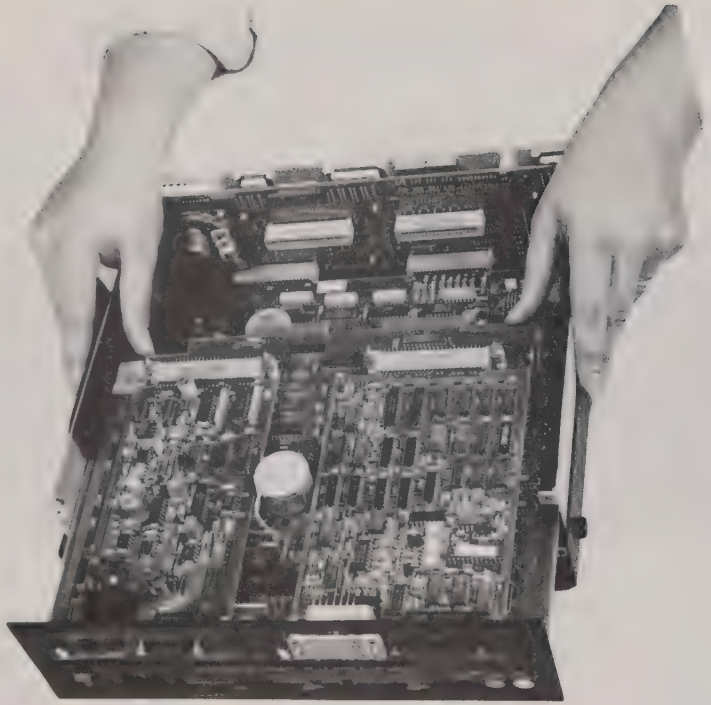

Figure 3-2
Sliding Top Board Assembly Out

DS0 operation and operation with the DSU Data Port and VF Interface options. These procedures assume that the user is familiar with the Model 124's front and rear panel controls; unfamiliar users should refer to Section 2.

3.6.2.1 Power-Up

(1) Insert the AC line cord into the AC receptacle on the Model 124's rear panel and plug the other end of the cord into a 115 VAC, 60 Hz power source.

WARNING: To minimize shock hazard, the instrument chassis must be connected to an electrical ground. The instrument is equipped with a three-conductor AC power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adaptor with grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet.

CAUTION: The Model 124 should always be operated with a 500 mA, 250V, fast-acting fuse (Littlefuse #217.500 or equivalent) installed. Always use correct fuse size. (See Section 7.2.2 for fuse replacement instructions.)

(2) Apply power to the Model 124 by placing the power switch in the "1" position.

(3) After the automatic self-test is successfully completed and before signal connections are made to the instrument, verify that the following indicators are illuminated:

Insert Side:	BYTE ENCODER
	NO PULSES
	NO FRAME
Drop Side:	RECEIVED BYTE (2-8)
	NO PULSES
	NO FRAME
Common Controls:	D3/D4
	64 kb/s (if the DSU Data Port Option is installed)

The displays should show the following:

Insert Side CHANNEL SELECT display:	"--"
Drop Side CHANNEL SELECT display:	"01"
Common Controls SLIPS display:	"----"

3.6.2.2 DS1 Operation

(1) Press the Insert Side CHANNEL SELECT switch to scroll "01" into the display. Ensure that the Drop Side CHANNEL SELECT display also shows "01".

(2) Connect one end of a 310-to-310 cable to the INSERT T1 OUTPUT connector on the rear panel. Connect the other end of the cable to the rear panel DROP T1 INPUT connector.

(3) Verify that the Drop Side NO PULSES and NO FRAME indicators are off and that the RECEIVED BYTE indicators display the same pattern as that selected by the BYTE ENCODER switches.

For example, if the BYTE ENCODER switches 1 through 4 are in the up position, and switches 5 through 8 are in the down position, the RECEIVED BYTE indicators 1 through 4 should be illuminated, and the indicators 5 through 8 should be off.

(4) Change the SOURCE SELECT switch to the 1004 Hz 0dBm0 position and verify operation of the SIGNALING switches by toggling the A and B switches and observing that the corresponding Drop Side SIGNALING LEDs follow. If a 4-Wire VF Interface is installed, adjust the volume control so that the 1004 Hz tone can be heard.

NOTE: Appendix A contains an extensive manual self-test which is more suitable for incoming inspection.

SECTION 4
OPERATION

4.1 INTRODUCTION

This section contains instructions for using the Model 124 Drop and Insert to insert data into or drop data from a T1 line. Specifically included are instructions for (1) using the RECEIVED BYTE indicators; (2) monitoring a VF channel; (3) testing a VF channel; (4) testing DDS data channels; (5) testing DS0 data; and (6) timing slips testing.

The following procedures assume that the user is familiar with the location and operation of the Model 124's controls and connectors and with the set-up and operation of a FIREBERD test set and any required interface. Unfamiliar users should refer to Section 2 (Instrument Description) for any questions about the Model 124.

4.2 MONITORING USING THE RECEIVED BYTE INDICATORS

To monitor a channel, perform the following steps.

(1) Set the power switch to the "1" position to apply power to the Model 124.

(2) Press the DS1 FORMAT switch to select the correct framing format.

(3) Set the Drop Side BRIDGE/TERM/DSX-MON switch to the correct position according to the location of your T1 access point. If the line is already terminated, use the BRIDGE position; if the T1 access point is a resistor-isolated monitor jack, use the DSX-MON position; if the Model 124 is used to terminate a line, use the TERM position.

(4) Ensure that the speaker will not be too loud by sliding the VOLUME control all the way to the left.

(5) Insert the T1 signal's WECO 310 connector into the DROP T1 INPUT jack on the rear panel.

(6) Verify that the Drop Side NO PULSE and NO FRAME indicators are **not** illuminated.

(7) Select the desired channel using the Drop Side CHANNEL SELECT switch.

(8) The desired data is now displayed in the RECEIVED BYTE indicators. An illuminated indicator corresponds to a logic one; an unlit indicator corresponds to a logic zero. The brightness of each indicator should give a rough idea of the relative ones density of each bit. The Drop Side SIGNALING indicators allow the signaling bits (A,B,C,D for ESF framing format; A,B for D1D, D2, or D3/D4 framing formats) to be monitored.

4.3 MONITORING A VF CHANNEL

To monitor a VF channel, perform the following steps (see Figure 4-1).

(1) Connect the Drop Side of the Model 124 to the T1 access point as described in Section 4.2, steps (1) through (7).

(2) The VF information (tone or conversation) can be monitored using the front-panel loudspeaker. A balanced 600-ohm output is available at the VF OUTPUT WECO 310 jack mounted on the VF interface.

4.4 TESTING A VF CIRCUIT FROM THE DSX PATCH BAY

To test a VF circuit from the DSX patch bay, perform the following steps (see Figure 4-2).

(1) Set the power switch to the "1" position to apply power to the Model 124.

(2) Press the DS1 FORMAT switch to select the correct framing format.

(3) Set the Insert Side BRIDGE/TERM/DSX-MON switch to the DSX-MON position.

(4) Insert the original T1 data traffic WECO 310 connector into the INSERT T1 INPUT jack.

(5) Select the desired T1 output line coding format using the AMI/B8ZS switch.

(6) Select the channels (all, none, or one) into which test information (voice or tone) will be inserted.

(7) Press the SIGNAL SOURCE switch to select either the internally generated 1004 Hz tone or the input from the VF interface option as the insert test data source. If the selected channel's signaling bits should be passed through the Insert Side without being altered, select the VF (THRU SIG) position.

(8) Plug the reconstructed T1 signal (with the test data), output at the INSERT T1 OUTPUT WECO 310 jack, into either the LINE or EQUIPT jack at the patch bay.

(9) The test channel tone or voice can now be accessed at the far end channel bank and tested with a VF test set or, if a loop-back is created, the test channel can be monitored with the Drop Side of the Model 124 as described in Section 4.3.

4.5 TESTING DDS DATA CHANNELS

To test DDS Data channels at the DSX patch bay using the DSU Data Port option, perform the following steps (see Figure 4-3).

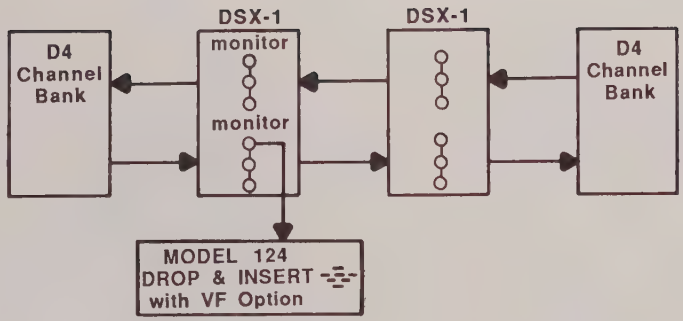

Figure 4-1
Monitoring a VF Channel From
the DSX Cross-Connect

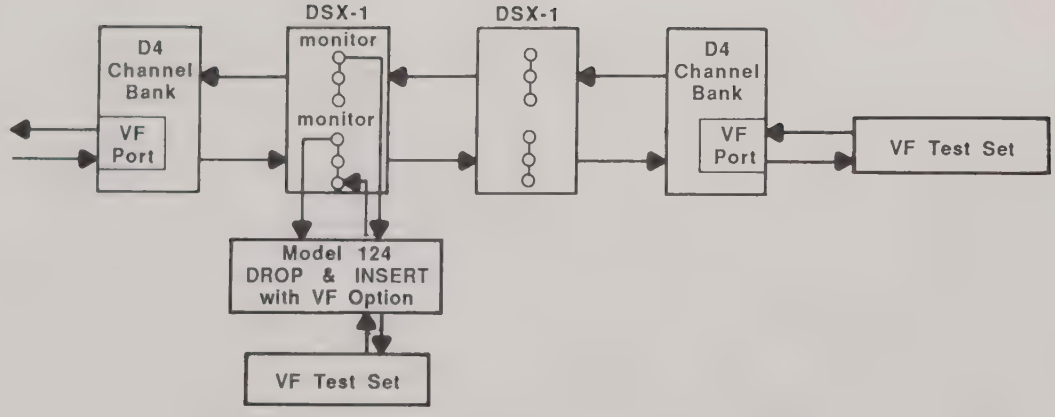

Figure 4-2

Testing a VF Circuit From the
DSX Patch Bay

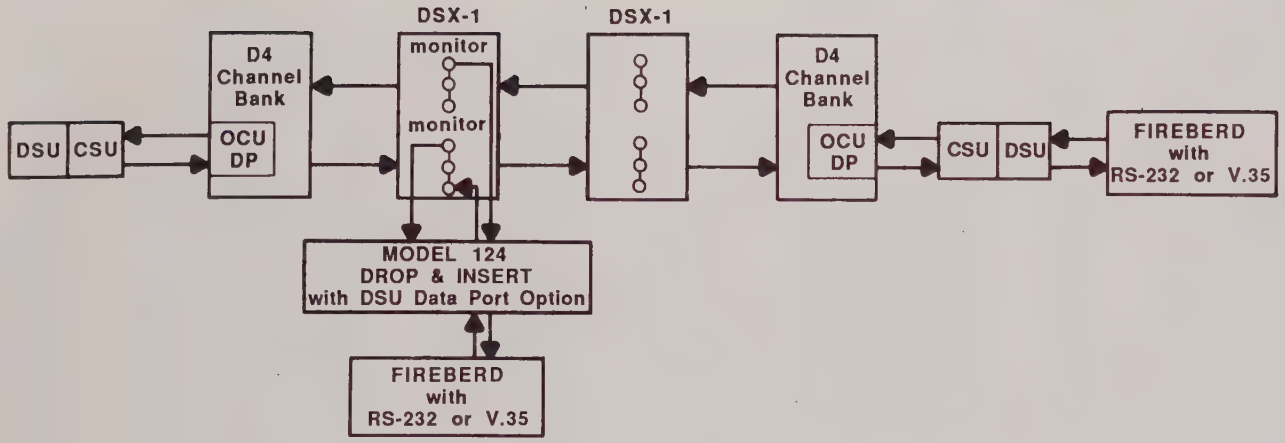

Figure 4-3

Testing DDS Data Channels Using the DSU Data Port Option

(1) Connect the Insert Side of the Model 124 to the monitor jack at the DSX patch bay as described in Section 4.4, steps (1) through (5).

(2) Press the Insert Side CHANNEL SELECT switch to choose the channel in which to insert test data.

(3) Press the DATA RATE switch to select the correct data rate for the DS0A-encoded data. Use the 64 kb/s setting for testing clear channel data.

(4) Connect a FIREBERD test set with either a V.35 or an RS-232 interface installed to the Model 124 DSU Data Port Interface.

(5) Press the SIGNAL SOURCE switch to choose the DSU DATA PORT data source.

(6) Plug the reconstructed T1 signal (with the test data), output at the INSERT T1 OUTPUT WECO 310 jack, into either the LINE or EQUIPT jack at the patch bay.

(7) The test channel data can now be accessed at the far end CSU/DSU's output and tested using a FIREBERD test set with either a V.35 or an RS-232 interface installed. If a loopback is created, the test channel can be monitored with the Drop Side of the Model 124 by connecting the output of the DSU Data Port option to a FIREBERD test set.

4.6 TESTING DS0 DATA

To test DS0 data, perform the following steps.

(1) Connect the Insert Side of the Model 124 to the monitor jack at the DSX patch bay as described in Section 4.4, steps (1) through (5).

(2) Press the Insert Side CHANNEL SELECT switch to choose the channel in which to insert test data.

(3) Connect a FIREBERD test set with a DS0 interface installed to the Model 124 DS0 interface.

(4) Press the SIGNAL SOURCE switch to choose the DS0 interface as the data source.

(5) Plug the reconstructed T1 signal (with the test data), output at the INSERT T1 OUTPUT WECO 310 jack, into either the LINE or EQUIPT jack at the patch bay.

(6) The test channel data can now be accessed at the far end channel bank and tested using a FIREBERD test set with a DS0 interface installed. If desired, loop codes can be generated by the FIREBERD to direct an OCU, CSU, or DSU loopback for the test channel data. The looped data can then be dropped by the 124 and output to the FIREBERD for testing.

NOTE: When data is both inserted from and dropped to a FIREBERD (or any test set with only one set of clock inputs), verify that DIP Switch 1 is in the up position (SYNC DS0 mode).

4.7 TIMING SLIPS TESTING

Both bit and frame timing slips testing can be performed. To test for timing slips between two T1 lines, perform the following steps.

(1) Connect the Timing Reference line to the INSERT T1 INPUT WECO 310 jack.

(2) Connect the DROP T1 INPUT to the line under test.

(3) Press the SLIPS switch into the RESET position and release to start the test.

(4) If both the INSERT T1 INPUT and DROP T1 INPUT signals are present, the SLIPS display will stop showing "--" and will display a number representing the number of bit slips from the reference signal. If either input is lost, the SLIPS display will begin flashing.

(5) The SLIPS switch can also be placed in the FRAME position. The SLIPS display will then increment whenever the two T1 signals slip by 193 bits in either direction.

(6) The SLIPS display can be used to discern the timing relationship between the two signals.

(a) If both signals are perfectly synchronized, the FRAME SLIPS display will remain at 0. The BIT SLIPS display may count up or down slightly indicating low-level jitter or wander but, over the long term, the BIT SLIPS COUNT will remain at 0.

(b) If the two signals are unsynchronized, and the frequency of the line under test (DROP T1 INPUT) is higher than the reference frequency (INSERT T1 INPUT), the BIT SLIPS count will increment. When the frequency of the line under test is lower than the reference frequency, the BIT SLIPS count will increment as the satellite gets closer (Blue shift) and decrement as the satellite moves farther away (Red shift). This movement would occur very slowly—over a matter of hours.

(c) If the two signals are unsynchronized, and the frequency of the line under test (DROP T1 INPUT) is higher than the reference frequency (INSERT T1 INPUT), the BIT SLIPS count will increment. When the frequency of the line under test is lower than the reference frequency, the BIT SLIPS count will decrement. The FRAME SLIPS display will increment every 193 bit slips.

SECTION 5
SPECIFICATIONS

5.1 INTRODUCTION

This section contains the specifications for the Model 124 Drop and Insert instrument.

5.2 DS1

5.2.1 Insert and Drop Inputs

- Connectors: WECO 310 jacks.
- Input Frequency: 1544000 Hz ± 1000 Hz.
- Input Impedance: BRIDGE—1000 ohms minimum.
  TERM—100 ohms ± 5%.
  DSX-MON—100 ohms ± 5%.
- Operating Range: BRIDGE—+6 dBdsx to -24 dBdsx. Automatic Line Build-out compensation for cable loss characteristics.
  TERM—+6 dBdsx to -24 dBdsx. Automatic Line Build-out compensation for cable loss characteristics.
  DSX-MON—+6 dBdsx to -24 dBdsx. No Automatic Line Build-out compensation; flat (resistive) loss compensation only.

5.2.2 Insert Output

- Connector: WECO 310 jack.
- Pulse Shape: With 100-ohm termination meets pulse shape specified in CCITT Recommendation G.703; Bell System Technical References CB113, CB119, CB132, CB143, PUB62508; and AT&T Technical Reference PUB62411, October 1986 Revision.
- Internal Oscillator Accuracy: 1.544000 MHz ± 5 ppm.
- Line Code: Selectable AMI or B8ZS.
- Idle Code: 0111 1111.

5.3 DS0 INTERFACE

5.3.1 Bipolar Input

- Connector: Bantam jack.
- Impedance: 135 ohms ± 10%.
- Operating Signal Level: 3.5 to 5.5 volts peak.
- Cable Length: 1500 feet of 24 gauge maximum.

5.3.2 Bipolar Output

- Data Rate: 64 kb/s.
- Connector: Bantam jack.
- Test Load Impedance: 135 ohms resistive.
- Pulse Amplitude: 4.0 volts ± 0.5 volts with a maximum imbalance of ± 0.25 volts.
- "Zero" Output Level: 0.7 volts maximum.
- Half Amplitude Pulse Width: 15.6 ± 0.5 microseconds with a minimum imbalance of 0.7 microseconds.
- Rise and Fall Time: 0.5 microseconds maximum.
- Data Format: Alternate Mark Inversion, Non Return to Zero.

5.3.3 Clocks (see Table 5-1)

5.3.3.1 Tx Clocks

- Tx (Insert) Bit Clock: Pin 3 (TTL level into 50 ohms).
- Tx (Insert) Bit Clock +: Pin 8 (differential).
- Tx (Insert) Bit Clock -: Pin 9 (differential).
- Tx (Insert) Byte Clock: Pin 4 (TTL level into 50 ohms).
- Tx (Insert) Byte Clock +: Pin 6 (differential).
- Tx (Insert) Byte Clock-: Pin 7 (differential).

5.3.3.2 Rx Clocks

- Rx (Drop) Bit Clock: Pin 3 (TTL level into 50 ohms).
- Rx (Drop) Bit Clock +: Pin 8 (differential).
- Rx (Drop) Bit Clock -: Pin 9 (differential).
- Rx (Drop) Byte Clock: Pin 4 (TTL level into 50 ohms).
- Rx (Drop) Byte Clock +: Pin 6 (differential).
- Rx (Drop) Byte Clock-: Pin 7 (differential).

Table 5-1
Tx and Rx Clocks Pin Assignments

PIN	SIGNAL NAME
1	Open
2	Circuit GND
3	Tx/Rx Bit Clock
4	Tx/Rx Byte Clock
5	Circuit GND
6	Tx/Rx Byte Clock +
7	Tx/Rx Byte Clock −
8	Tx/Rx Bit Clock +
9	Tx/Rx Bit Clock −

5.3.3.3 Differential Drivers

- Test Load: 1000 ohms.
- Pulse Amplitude: High—2.5 volts minimum.
  Low—0.5 volts maximum.

5.3.3.4 TTL Driver

- Test Load: 50 ohms.
- Pulse Amplitude: High—2.5 volts minimum.
  Low—0.4 volts maximum.
- Rise and Fall Time: 25 nanoseconds typical.

5.4 DSU DATA PORT (OPTION)

5.4.1 RS-232

- Data Rates: 2.4, 4.8, 9.6, 56*, 64 kb/s*.
- Data Polarity: Mark (binary "1") -3 to -25 volts.
  Space (binary "0") +3 to +25 volts.
- Drivers: Output levels into 3k ohms load (typical).
  Low Level: -10 volts ± 1 volt.
  High Level: +10 volts ± 1 volt.
- Slew Rates into 7k ohms resistive load (typical):
  Clock and Data: 25 volts/microsecond.
  Signaling: 2 volts/microsecond.
- Maximum Short-Circuit Current: ± 12 mA.
- Receivers: Input Impedance: 3k—7k ohms
  Input Threshold (typical): Positive-going: +2 volts.
  Negative-going: – 1 volt.
- Maximum Input Voltage: ± 25 volts.
- Connector: 25-pin D, Female. (See Table 5-2.)

5.4.2 V.35

- Data Rates: 2.4, 4.8, 9.6, 56, 64, kb/s.
- Data Polarity: Mark (binary 1) : "A" lead negative with respect to "B" lead.
  Space (binary 0) : "A" lead positive with respect to "B" lead.

* These data rates exceed the speed limitations set forth in RS-232C and V.24. However, the RS-232 connector can be used at the cost of increased bias distortion and clock data skew.

Table 5-2

DSU Data Port RS-232 Connector Pin Assignments

PIN	CIRCUIT	SIGNAL NAME	PIN STATUS
1	AA	Protective Ground	Chassis GND
2	BA	Transmitted Data	Input
3	BB	Received Data	Output
4	CA	Request to Send	Input
5	CB	Clear to Send	Output
6	CC	Data Set Ready	Output
7	AB	Signal Ground	Signal GND
8	CF	Received Line Signal Detect	Output
15	DB	Transmit Signal Element Timing	Output
17	DD	Receiver Signal Element Timing	Output

- Clock Polarity: OFF: "A" lead negative with respect to "B" lead.
  ON : "A" lead positive with respect to "B" lead.
- Signaling Polarity: OFF: -3 to -25 volts.
  ON: +3 to +25 volts.
- Data and Clock Drivers: Source Impedance—100 ± 50 ohms.
  Resistance from Short-Circuited Terminals to Ground—150 ± 15 ohms.
- Data and Clock Receivers: Input Impedence—100 ± 10 ohms.
  Resistance from Short-Circuited Terminals to Ground—150 ± 15 ohms.
  Input Hysteresis—70 mV typical.
- Signaling Drivers—Output Levels into 3k ohm load (typical):
  OFF: -10 volts ± 1 volt.
  ON: +10 volts ± 1 volt.
  Slew Rate into 7k ohm load (typical):
  2 volts/microseconds.
  Maximum Short-Circuited Current: ± 12 mA.
- Signaling Receivers - Input Impedance: 3k to 7k ohms.
  Input Thresholds (typical):
  OFF to ON: +2 volts.
  ON to OFF: − 1 volt.
  Maximum Input Voltage: ± 25 volts.
- Connector: 34-pin, Female. (See Table 5-3.)

5.5 VF MEASUREMENT (OPTION)

5.5.1 Transmit (Drop) Side

- Driver: 600 ohms with minimum 28 dB return loss, 300-3400 Hz.

Table 5-3

DSU Data Port V.35 Connector Pin Assignment

PIN	CIRCUIT	SIGNAL NAME	PIN STATUS
A	101	Protective Ground	Chassis GND
B	102	Signal Ground	Signal GND
C	105	Request to Send	Open
D	106	Clear to Send	Output
E	107	Data Set Ready	Output
F	109	Received Line Signal Detect	Output
H	108	Data Terminal Ready	Open
J	125	Ring Indicator	Open
K	—	Reserved	Open
P,S	103	Send Data	Input
R,T	104	Receive Data	Output
U,W	113	Serial Clock Transmit External	Open
V,X	115	Serial Clock Receive	Output
Y,AA	114	Serial Clock Transmit	Output

Note: For balanced circuits the "A" lead is listed first, the "B" lead is second.

- Frequency Response: ± 0.25 dB (300-3000 Hz).
  + 0.25, -1.5 dB (3000-3400 Hz).
- Tracking Distortion (relative to 1004 Hz, -10 dBm0): ± 0.3 dB (±3 dBm0 to -40 dBm0).
  ± 0.6 dB (-40 dBm0 to -50 dBm0).
  ± 1.6 dB (-50 dBm0 to -55 dBm0).
- Transmission Level Points (selectable): 0 dBm0 = 0 dBm.
  0 dBm0 = +7 dBm.
- Connector: WECO 310 jack.

5.5.2 Receive (Insert) Side

- Receiver: 600 ohms with minimum 28 dB return loss, 300-3400 Hz.
- Frequency Response (relative to 1004 Hz, 0 dBm0): ± 0.25 dB (300-3000 Hz).
  + 0.25, -1.5 dB (3000-3400 Hz).
- Tracking Distortion (relative to 1004 Hz, -10 dBm0): ±0.3 dB (+3 dBm0 to -40 dBm0).
  ±0.6 dB (-40 dBm0 to -50 dBm0).
  ±1.6 dB (-50 dBm0 to -55 dBm0).
- Transmission Level Points (selectable): 0 dBm0 = 0 dBm.
  0 dBm0 = -16 dBm.
- Clipping Point: +3 dBm0 nominal.

- Signal to Distortion Ratio: 33 dB minimum (0 to -30 dBm0)*.
- Idle Channel Noise: 18 dBrnc0 maximum.
- Connector: WECO 310 jack.

5.5.3 Signaling

- Connector: 15-Pin D, Female. (See Table 5-4.)
- Signaling Inputs -
  Input Voltage Range: -0.5 volts to +25 volts.
  Logic 0 (On Hook) Input: Open circuit or +2.5 volts to +25 volts.
  Logic 1 (Off Hook) Input: Closure to ground or -0.5 volts to +1.0 volts.
  Input Current: -1.5 micro amps maximum at 0 volts.
  +1.0 micro amps maximum at +3.0 volts.
- Signaling Outputs -
  Logic 0 (On Hook) Output: +1.1 volt maximum for 0 to 100 mA sink current.
  +1.6 volt maximum for 0 to 300 mA sink current.

* Measured with C-message and C-message with notch filter.

Table 5-4

Pin Assignments, Signaling Connector

PIN	SIGNAL
1	Chassis Ground
2	Signaling Output—A
3	Signaling Output—B
4	Signaling Output—C
5	Signaling Output—D
6	Signal Ground
7	Signal Ground
8	Signal Ground
9	Signaling Input—A
10	Signaling Input—B
11	Signaling Input—C
12	Signaling Input—D
13	Front Panel/Connector Control Input*
14	Signal Ground
15	Signal Ground

* When Pin 13 is a TTL high or unconnected, the transmit signaling is controlled by the Model 124 front-panel switches. When brought to a TTL low, transmit signaling is controlled by the external signal sources—Pins 9-12.

Logic 1 (Off Hook) Output: +3.0 volt minimum for 0 to 350 micro amps source current.
+4.0 volt minimum for 0 to 150 micro amps source current.
Output Voltage Range: -0.5 volts to +25 volts.

5.6 FRONT PANEL

5.6.1 Insert Side

5.6.1.2 Insert Side Switches

- CHANNEL SELECT: 1,2,3,4,...,23,24, All, — (none).
- SIGNAL SOURCE: BYTE ENCODER, DSO INPUT, 1004 Hz 0dBm0, VF, VF (THRU SIG), DATA PORT.
- VF SIGNALING: A, B, C, and D switches "ON and "OFF" positions.
- BYTE ENCODER: 1,2,3,4,5,6,7,8 switches "1" and "0" positions.
- BRIDGE/TERM/DSX-MON: BRIDGE, TERM, DSX-MON positions.
- AMI/B8ZS: AMI and B8ZS positions.

5.6.1.2 Insert Side Indicators

- All indicators remain on for at least 100 milliseconds after each event.

Alarm Indicators

NO PULSES	This indicator will be illuminated when no signal is detected for 150 ms or more.
NO FRAME	This indicator will be illuminated when the Model 124 is unable to achieve frame synchronization. Frame loss threshold is: D1D,D2,D3/D4,SLC-96 2 errors in 5 Ft frame bits. ESF 2 errors in 5 frame bits.
FRAME/CRC ERR	This indicator will be illuminated when either a framing bit error (D1D, D2, D3/D4, or SLC-96) or a CRC error (ESF) is detected.
BPV	This indicator will be illuminated when a bipolar violation is detected. Note that B8ZS codes will not cause this indicator to illuminate.
REM ALARM	This indicator will be illuminated when a yellow alarm signal is detected. A yellow alarm is declared when: (1) for D1D, D2, D3, D4, and SLC-96, bit 2 of each channel is a "0" for 255 consecutive channels; or (2) for ESF, 256 bits ±16 bits of a repetitive "1111 1111 0000 0000" pattern is detected in the 4 kb/s data link.

AIS — This indicator will be illuminated when an Alarm Indication Signal (2048 or more consecutive ones) is detected.

Signaling Indicators

- SIGNALING A,B,C,D Indicators (within the signaling switches): Indicate the state of the signaling bits (On = 1; Off = 0) being inserted into the selected channel(s). Signaling sources are:
  (a) Front-panel switches.
  (b) 4-Wire VF Interface 9-pin D connector.
  (c) The selected Insert channel original signaling (VF THRU SIG).

5.6.2 Common Controls

5.6.2.1 Bit Slips Measurement

- Range: ± 192.
- Resolution: 1 clock period.
- Display: 4-digit, 7-segment LED.

5.6.2.2 Frame Slips Measurement

- Range: 0-9999.
- Resolution: 1 frame (193 clock periods).

5.6.2.3 Switches

- DS1 FORMAT: D1D, D2, D3/D4, ESF, and SLC-96 positions.
- DATA RATE: 2.4, 4.8, 9.6, 56, and 64 kb/s.

5.6.3 Drop Side

5.6.3.1 Drop Side Switches and Controls

- CHANNEL SELECT: 1,2,3,4,...,23,24.
- VOLUME: Continuously adjustable low/high.
- BRIDGE/TERM/DSX-MON: BRIDGE, TERM, and DSX-MON positions.

5.6.3.2 Drop Side Indicators

- RECEIVED BYTE: 1,2,3,4,5,6,7,8.
- SIGNALING: A,B,C,D.
  ON = Logic 1.
  OFF = Logic 0.

- Alarm Indicators: NO PULSES, NO FRAME, FRAME/CRC ERR, BPV, REM ALARM, AIS (see Section 5.6.1.2 for specifications).

5.7 PHYSICAL

- Case Dimensions: 3.5" high x 12" wide x 11.4" deep (8.9 cm x 35 cm x 29 cm).
- Weight: 8.25 lbs. (3.75 kg) with options installed.

5.8 OPERATIONAL

- Power Requirements: 115 volts AC ± 10%, 60 Hz.
- Fuse: 500 mA, 250 volts Metric (5mm x 20mm), fast-acting (Littlefuse #217.500 or equivalent).
- Operating Temperature Range: 32°F to 122°F (0°C to 50°C).
- Storage Temperature Range: -4°F to 158°F (-20°C to 70°C).

5.9 GROUNDING

- Chassis and signal grounds isolated by 150-ohm ½-watt resistor.
- Bantam and 310 jack sleeves connected to chassis ground.
- Power cord center ground pin connected to chassis ground.
- 9-pin D connector pins 2 and 5 connected to signal ground.
- 15-pin D connector pin 1 connected to chassis ground. Pins 6, 7, 8, 14, and 15 connected to signal ground.
- Ground test point connected to signal ground.
- 25-pin D connector pin 1 connected to chassis ground and pin 7 connected to signal ground.
- V.35 connector pin A connected to chassis ground.

SECTION 6
OPTIONS AND ACCESSORIES

6.1 INTRODUCTION

This section describes the options and accessories that are available for use with the Model 124 Drop and Insert instrument.

6.2 OPTIONS

6.2.1 4-Wire VF Interface Option (Model 40639)

The 4-Wire VF Interface provides test access to the digitally encoded VF signals at any T1 access point. This allows VF test sets, which were traditionally only used at analog test points, to have access to the VF information at any T1 access point. WECO 310 connectors are provided for input and output connections. The interface converts analog VF signals present at its VF INPUT connector into digital signals suitable for transmission on T1 systems. The interface also performs the reverse process: converting digital signals taken from a DS1 signal and converting them into analog VF signals. In addition to the 600-ohm electrical interface, the Model 124 provides a speaker output which allows the user to listen to VF signals; this enables the user to identify circuits as well as determine if impairments are present. A volume control on the Model 124 front panel allows the audio volume to be adjusted. Automatic Gain Control (AGC) is provided in the speaker drive circuit to expand the range of signal level that can be listened to.

6.2.1.1 Transmission Level Points

The 4-Wire VF Interface provides two Transmission Level Point (TLP) settings. These TLP settings are controlled by DIP Switch 2 on the Model 124 rear panel. The 0,0 TLP (up) position sets both the transmit and receive TLPs at 0dBm0 = 0dBm. The +7,-16 TLP (down) position sets the transmit (drop side) TLP at 0 dBm0 = +7 dBm and the receive (insert side) TLP at 0 dBm0 = -16dBm.

6.2.1.2 Signaling

Signaling input and output is provided at the 4-Wire VF Interface's 15-pin D connector. Connections are provided for both the dropped channel signaling outputs and the insert channel signaling inputs. Table 5-4 contains the signaling connector's pin assignments. Note that Pin 13 must be connected to ground before signaling inputs are accepted from the rear panel inputs. LED indicators within the Insert Side SIGNALING switches will indicate the signaling state being inserted, thus allowing setup confirmation before going on-line.

6.2.1.3 Installation

To install the 4-Wire VF Interface, use the following procedure.

(1) Using a Phillips screwdriver, remove the four screws which secure the top cover to the instrument and remove the cover.
(2) Remove the blank-off plate, which is directly above the AC connector on the rear panel, by removing its two screws.
(3) Install the 4-Wire VF Interface through the rear panel and guide it into the edge connector.
(4) Using the screws which held on the blank-off plate, secure the 4-Wire VF Interface to the rear panel.
(5) Replace the top cover by inserting the four screws which hold it in place.
(6) Perform the electrical checkout procedure in Appendix A to verify proper operation.

6.2.2 DSU Data Port Interface Option (Model 40641)

The DSU Data Port Interface allows access to DS0A-encoded DDS data at 2.4, 4.8, 9.6, 56, or 64 kb/s. The interface's panel provides both a V.35 and an RS-232 connector, allowing access to the data within a DS1 stream.

6.2.2.1 Transmitting Data

The DSU Data Port Interface provides transmit clocks synchronized to the DS1 framing pattern. These clocks must be used by the data terminal equipment (DTE) as the timing source in generating data. The V.35 and RS-232 connectors are configured as DCE (see Section 5.4 for pin assignments). Before the interface will accept data from DTE equipment, the following conditions must be met: (1) the Model 124 Insert Side must be synchronized to the received frame pattern; (2) the INSERT CHANNEL SELECT switch must be set to a position other than "--" (none); (3) the SOURCE SELECT switch must be set to the DSU DATA PORT position; and (4) for RS-232, the RTS signaling lead must be true. When these conditions are met, the CTS lead will be set true indicating that the instrument is ready to accept data. This data will be formatted into the appropriate DDS format for the selected data rate and transmitted in the selected channel(s).

6.2.2.2 Receiving Data

Data dropped from the selected DS1 channel is simultaneously routed to both the V.35 and the RS-232 connectors along with the received clock. The RLSD lead will be true when bit 8 of the dropped channel is a "1" for data rates of 2.4, 4.8, 9.6, and 56 kb/s, which usually indicates that customer data is present. This line will be held true when the 64 kb/s data rate is selected.

6.2.2.3 Installation

To install the DSU Data Port Interface, use the following procedure.

(1) Using a Phillips screwdriver, remove the four screws which secure the top cover to the instrument and remove the cover.

(2) Remove the blank-off plate, which is directly above the T1 connectors and output connectors on the rear panel, by removing its two screws.

(3) Install the DSU Data Port Interface through the rear panel and guide it into the edge connector.

(4) Using the screws which held on the blank-off plate, secure the DSU Data Port to the rear panel.

(5) Replace the top cover by inserting the four screws which hold it in place.

(6) Perform the electrical checkout procedure in Appendix A to verify proper operation.

6.3 ACCESSORIES

Various accessories for use with the Model 124 are described below. Contact TTC's Customer Service Department for ordering information.

6.3.1 Rack Mount (Models 10801-01 and 10801-02)

Two rack mounts are available for the Model 124: Model 10801-01 allows mounting in a standard 19" equipment rack; Model 10801-02 allows mounting in a 23" rack. To install the Model 124 in either rack mount, use the following procedure.

(1) Remove the four screws which secure the front of the top and bottom covers (see Figure 6-1). **Do not** remove the covers completely.

(2) Install the rack mount bracket with the 3 holes to the left side of the Model 124 using two #6-32 pan head screws and lock washers (see Figure 6-2).

(3) Install the remaining bracket to the right side of the Model 124 using the #6-32 pan head screws and lock washers (see Figure 6-3).

(4) Install the three cable assemblies (provided with the rack mount) in the left rack mount bracket. Mount the jack end of each cable in the bracket hole and tighten the 1/2" hex locknut (3 places). Install the plug end of each cable in the corresponding jack on the rear panel (see Figure 6-4).

(5) Remove the four feet from the bottom of the Model 124 to install the unit in the standard 3 1/2" panel height.

Figure 6-1
Removing Top and Bottom Cover Screws

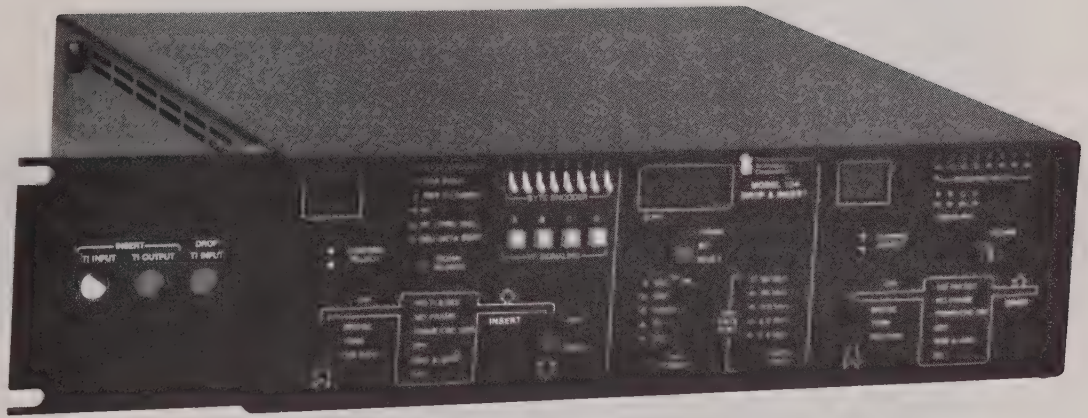

Figure 6-2
Installing Left Rack Mount Bracket

Figure 6-3
Installing Right Rack Mount Bracket

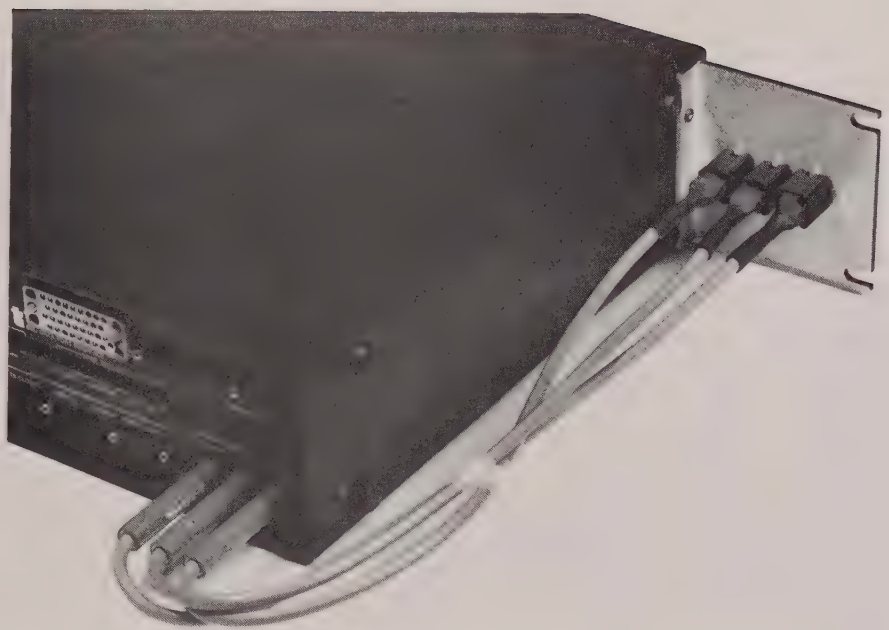

Figure 6-4
Installing Cable

6.3.2 Soft Carrying Case (Model 40661)

The Model 124 Soft Carrying Case is constructed of navy blue canvas with dense foam inserts. The top cover is hinged and secured with Velcro fasteners. The case is supported by a wrap-around nylon handle with a 3-snap grip. One side of the case features a separate-access pouch that accommodates several accessory cables and an operating manual. The dimensions of the case are 15" wide x 4 3/8" deep x 13 3/4" high (38.1 cm x 11.1 cm x 14.9 cm).

6.3.3 Cables

The following is a list of the accessory cables that are available from TTC for use with the Model 124.

PART NUMBER	DESCRIPTION
10598	WECO 310 plug to WECO 310 plug cable (4')
10420	WECO 310 plug to WECO 310 plug cable (10')
10558	WECO 310 plug to alligator clips cable (10')
10599	WECO 310 plug to bantam plug cable (4')
10559	WECO 310 plug to bantam plug cable (10')
10213	RS-232/V.24 male-to-male cable (6')*
10418	RS-232/V.24 male-to-male cable (10')*
10214	V.35/306 male-to-male cable (6')*
10419	V.35/306 male-to-male cable (10')*
30488	Replacement clock cable for DS0 Interface
30611	9-pin D to 5-pin male connector (4')

* For use with Model 40641 DSU Data Port Interface.

SECTION 7
MAINTENANCE AND SERVICE

7.1 INTRODUCTION

This section contains information on maintenance and service for the Model 124 Drop and Insert instrument. Specifically, it includes steps to take should the user experience difficulty operating the Model 124, instructions for replacing the fuse, and a description of TTC's warranty and repair procedures.

7.2 MAINTENANCE

7.2.1 In Case of Difficulty

If the Model 124 fails to operate and no front-panel indicators are illuminated, check the following:

AC power cord and AC supply
AC fuse and fuse size

If some indicators are illuminated, but the Model 124 fails to operate properly, follow the self-test procedure in Section 3 as an aid to localizing the problem. If the instrument cannot be made to operate properly, call the TTC Customer Service Department.

7.2.2 Fuse Replacement Instructions

The Model 124's fuse is located to the left of the AC receptacle on the rear panel. If faulty, the fuse should be replaced with a 500 mA, 250V, fast-acting fuse (Littlefuse #217.500 or equivalent). Always use the correct fuse size. To replace the fuse, use the following procedure.

(1) Locate the plastic fuse holder beside the AC receptacle.

(2) Using a screwdriver or similar instrument, **gently** pry the fuse holder out of the rear panel.

NOTE: When shipped from the factory, the fuse holder contains a spare AC line fuse.

(3) Remove the old fuse and install a new fuse of the correct size.

(4) Press the plastic fuse holder securely back into place beside the AC receptacle.

7.3 SERVICE

7.3.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization is granted by TTC.

The Model 124 Drop and Insert instrument will be repaired or replaced (at our option) for a period of one (1) year after original receipt by the customer. Data interfaces, cables, breakout boxes, and accessories will also be repaired or replaced (at our option) for a period of one (1) year after original receipt by the customer.

Liability under this warranty extends only to the replacement value of the equipment. This warranty is void under the following conditions:

(1) Equipment has been altered or repaired without specific authorization by TTC.

(2) Equipment is installed or operated other than in accordance with instructions contained in TTC literature and operating manuals.

No other warranty is expressed or implied. TTC is not liable for consequential damages.

7.3.2 In-Warranty Service

Equipment in warranty must be returned to the factory with shipping prepaid. The equipment should be packed and shipped in accordance with the instructions contained in Section 7.3.4 of this manual. Defective units will be repaired or replaced (at out option) depending on severity of defect. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Customer Service Department. The RA number should then appear on all paperwork and be clearly marked on the outside of the equipment container.

After the equipment is repaired by TTC, it will be tested to applicable specifications, burned-in for at least 24 hours, and returned to the customer with shipping prepaid. A brief description of the work performed and the materials used will be provided on the Equipment Repair Report furnished with the returned equipment.

7.3.3 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty. However, there is a minimum charge of $75.00 applied to each request for out-of-warranty service. The $75.00 minimum

charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment be repaired. The customer will be billed for parts plus standard labor rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair can be started, and a hard copy of the purchase order must be received by TTC before the repaired equipment can be shipped to the customer. A description of the labor and materials used will be provided in the Equipment Repair Report.

7.3.4 Equipment Return Instructions

To all equipment returned for repair, the customer should attach a tag that includes the following information.

(1) Owner's name and address.

(2) A list of the equipment being returned and the applicable serial number(s).

(3) A detailed description of the problem or service requested.

(4) The name and telephone number of the person to contact regarding questions about the repair.

(5) The Return Authorization (RA) number.

If possible, the customer should return the equipment using the original shipping container and material. If the original container is not available, the instrument should be carefully packed so that it will not be damaged in transit. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

APPENDIX A
INSTRUMENT CHECKOUT

The following sections provide procedures which can be used to verify proper operation of the Model 124. These procedures are suitable for incoming inspection acceptance testing.

A.1 AUTOMATIC SELF-TEST

The automatic self-test is actually a series of diagnostic tests that are performed at power-up by the Model 124 to ensure that it is functioning correctly. The automatic self-test performs the following functions:

- All of the indicators and the displays are illuminated for approximately 1 second at power-up.
- Random Access Memory (RAM) and Read Only Memory (ROM) are checked at power-up. If one or both of these tests fail, the Model 124 will display an error message in the SLIPS display; TTC should be called for service.

A.2 MANUAL SELF-TEST

The Manual Self-Test is split into several procedures pertaining to power-up, DS1 operation, DS0 operation, and the DSU Data Port and VF options. These procedures assume that the user is familiar with the Model 124's front and rear panel controls; unfamiliar users should refer to Section 2. Certain of the following procedures will refer to testing with test equipment manufactured by TTC such as the FIREBERD (1500A, 2000, 6000). However, any test equipment with similar functions can be used.

A.2.1 Power-Up

(1) Insert the AC line cord into the AC receptacle on the Model 124's rear panel and plug the other end of the cord into a 115 VAC, 60 Hz power source.

WARNING: To minimize shock hazard, the instrument chassis must be connected to an electrical ground. The instrument is equipped with a three-conductor AC power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adaptor with grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet.

CAUTION: The Model 124 should always be operated with a 500 mA, 250V, fast-acting fuse (Littlefuse #217.500 or equivalent). Always use correct fuse size. (See Section 7.2.2 for fuse replacement instructions).

(2) Apply power to the Model 124 by placing the power switch in the "1" position.

(3) After the automatic self-test is successfully completed and before signal connections are made to the instrument, verify that the following indicators are illuminated:

Insert Side:	BYTE ENCODER
	NO PULSES
	NO FRAME
Drop Side:	RECEIVED BYTE (2-8)
	NO PULSES
	NO FRAME
Common Controls:	D3/D4
	64 kb/s (if DSU Data Port option is installed)

The displays should show the following:

Insert Side CHANNEL SELECT display:	"--"
Drop Side CHANNEL SELECT display:	"01"
Common Controls SLIPS display:	"----"

A.2.2 Loopback Operation

A.2.2.1 Equipment Required

QUANTITY	DESCRIPTION	TTC PART NUMBER
1	310-to-310 Cable	10598 or 10420

A.2.2.2 Procedure

(1) Press the Insert Side CHANNEL SELECT switch to scroll "01" into the display. Ensure that the Drop Side CHANNEL SELECT display also shows "01".

(2) Connect one end of a 310-to-310 cable to the INSERT T1 OUTPUT connector on the rear panel. Connect the other end of the cable to the rear panel DROP T1 INPUT connector (see Figure A-1).

(3) Verify that the Drop Side NO PULSES and NO FRAME indicators are off and that the RECEIVED BYTE indicators display the same pattern as that selected by the BYTE ENCODER switches.

Figure A-1
Cable Connection – Loopback Operation

For example, if the BYTE ENCODER switches 1 through 4 are in the up position, and switches 5 through 8 are in the down position, the RECEIVED BYTE indicators 1 through 4 should be illuminated, and the indicators 5 through 8 should be off.

(4) Change the SOURCE SELECT switch to the 1004 Hz 0dBm0 position and verify operation of the SIGNALING switches by toggling the A and B switches and observing that the corresponding Drop Side SIGNALING LEDs follow. If a 4-Wire VF Interface is installed, adjust the volume control so that the 1004 Hz tone can be heard.

A.2.3 Insert Transparency

A.2.3.1 Equipment Required

QUANTITY	DESCRIPTION	TTC PART NUMBER
2	310-to-310 Cable	10598 or 10420
1	Communications Analyzer	FIREBERD 1500A, 2000, 6000
1	DS1/T1 (D4 Framing) Interface	40405

A.2.3.2 Procedure

(1) Set the insert side CHANNEL SELECT to the none ("--") position and the DS1 FORMAT switch to the D3/D4 position.

(2) Configure the FIREBERD to transmit a T1 QRSS signal with D4 framing.

(3) Connect the output signal from the FIREBERD to the INSERT T1 INPUT of the Model 124 using the 310-to-310 cable. Connect the receive input of the FIREBERD's interface to the Model 124 INSERT T1 OUTPUT (see Figure A-2).

(4) Restart the FIREBERD and verify that PATTERN SYNC and FRAME SYNC are present. Confirm that no bit errors are being detected in the data by selecting the appropriate result.

(5) Change the Insert Side CHANNEL SELECT switch to the "01" position and verify that bit errors are accumulating in the FIREBERD display.

A.2.4 DS0 Operation

A.2.4.1 Equipment Required

QUANTITY	DESCRIPTION	TTC PART NUMBER
1	310-to-310 Cable	10598 or 10420
1	Communication Analyzer	FIREBERD 1500A, 2000, 6000

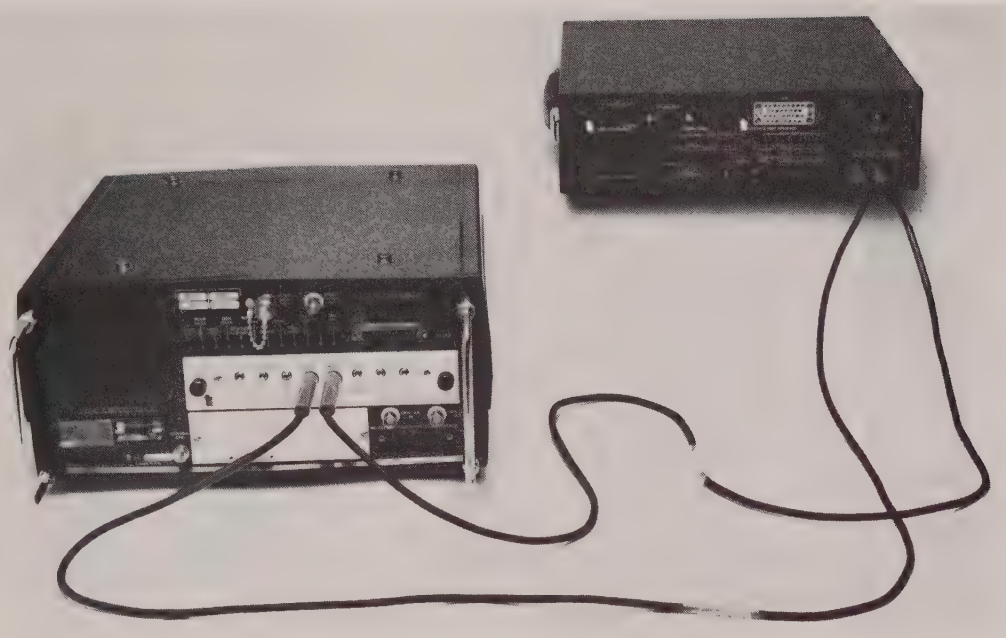

Figure A-2
Cable Connection – Insert Transparency

1	DS0/DS0A Interface Adaptor	30481
1	Clock Cable	30488
2	Bantam-to-Bantam Cable	10615

A.2.4.2 Procedure

(1) Insert a DS0/DS0A Interface into the FIREBERD.

(2) Ensure that DIP Switch 1 is in the DS0 SYNC (up) position on the rear panel of the Model 124.

(3) Connect one end of the clock cable (30488) to either the TX CLOCKS output or the RCV CLOCKS output on the Model 124 and the other end to the CLOCKS input on the DS0/DS0A Interface (see Figure A-3).

(4) Connect two bantam-to-bantam connector cables, each to the respective input and output jacks on the Model 124 and the DS0/DS0A Interface. Refer to the proper FIREBERD operating manual for instructions on FIREBERD DS0 operation (see Figure A-3).

(5) Connect the Model 124's INSERT T1 OUTPUT to the DROP T1 INPUT using the 310-to-310 cable.

(6) Set the DS0/DS0A Interface switch as follows:

Switch	Position
DATA TYPE	BIPOLAR
DATA RATE (kb/s)	56
LOOP	NONE
DS0	CLR CHAN TEST

(7) Set the SIGNAL SOURCE switch to the DS0 position.

(8) Use the Model 124's Insert Side CHANNEL SELECT switch to select channel 01. Configure the FIREBERD to transmit a 1:3 pattern.

(9) Drop channel 01 and verify that the Model 124's RECEIVED BYTE indicators show the 1:3 pattern and that the FIREBERD's SYNC indicator is illuminated with no errors accumulating.

(10) Set the DS0/DS0A Interface's toggle switch to the TEST position and the DATA RATE (kb/s) switch to the 56 position.

(11) Verify that the FIREBERD's SYNC indicator is illuminated and that no errors are accumulating.

(12) Disconnect the clock and bantam cables from the Model 124. Remove the DS0/DS0A Interface from the FIREBERD.

A.2.5 DSU Data Port Operation (Option)

If the optional DSU Data Port Interface is not installed in your Model 124, skip this section and proceed to Section A.2.6.

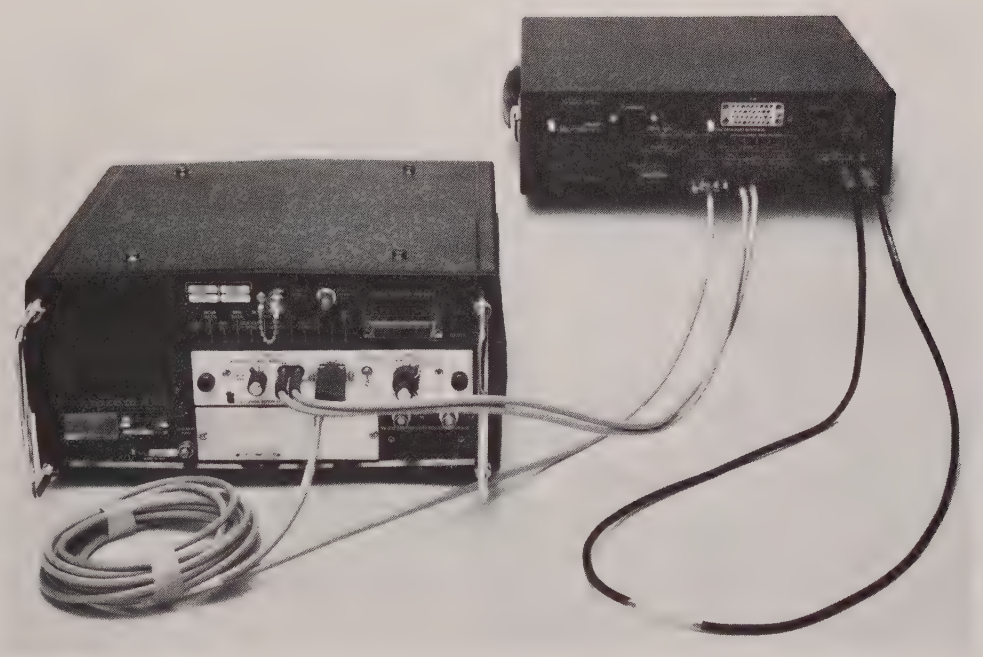

Figure A-3
Cable Connection – DS0 Operation

A.2.5.1 Equipment Required

QUANTITY	DESCRIPTION	TTC PART NUMBER
1	310-to-310 Cable	10598 or 10420
1	Communication Analyzer	FIREBERD 1500A, 2000, 6000
1	V.35/306 DTE/DCE Interface	40202
1	RS-232 Sync DTE/DCE Interface	40236*
1	RS-232/V.24 male-to-male cable	10213 or 10418
1	V.35/306 male-to-male cable	10214 or 10419

* Not required for the FIREBERD 6000.

A.2.5.2 DSU Data Port V.35 Operation

(1) Insert a V.35/306 DTE/DCE Interface in the FIREBERD.

(2) Connect a V.35 cable between the Model 124 and the FIREBERD (see Figure A-4).

(3) Set the FIREBERD for an external generator clock source.

(4) On the Model 124, set the SIGNAL SOURCE switch to the DSU DATA PORT position, the DS1 FORMAT switch to the D3/D4 position, and the DSU DATA PORT DATA RATE switch to the 64 kb/s position.

(5) Connect the Model 124's INSERT T1 OUTPUT to the DROP T1 INPUT using the 310-to-310 cable.

(6) Set the Insert Side and Drop Side CHANNEL SELECT switches to the same channel and verify that the FIREBERD's SYNC indicator is illuminated and that no errors are accumulating.

(7) Step the DATA RATE switch through each position, pausing to restart the FIREBERD and verify that the FIREBERD's SYNC indicator is illuminated and that no errors are accumulating.

(8) Disconnect the V.35 cable from the Model 124 and the FIREBERD. Remove the V.35/306 DTE/DCE Interface from the FIREBERD.

A.2.5.3 DSU Data Port RS-232 Operation

(1) Insert an RS-232 DTE/DCE Interface in the FIREBERD.

NOTE: The FIREBERD 6000 is equipped with a built-in RS-232 interface; the FIREBERD 1500A and 2000 require an interface module.

(2) Connect an RS-232 cable between the Model 124 and the FIREBERD. (See Figure A-5).

(3) On the FIREBERD, select an external clock source.

(4) Set the RTS signaling line ON.

(5) Verify that the FIREBERD's SYNC indicator is illuminated and that no errors are accumulating.

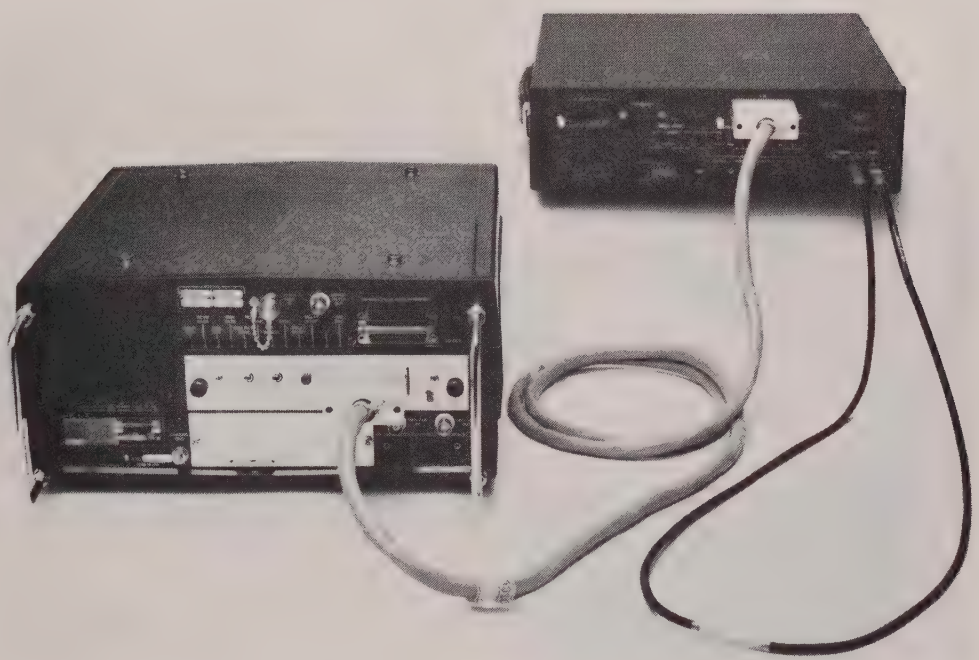

Figure A-4
Cable Connection - DSU Data Port V.35 Operation

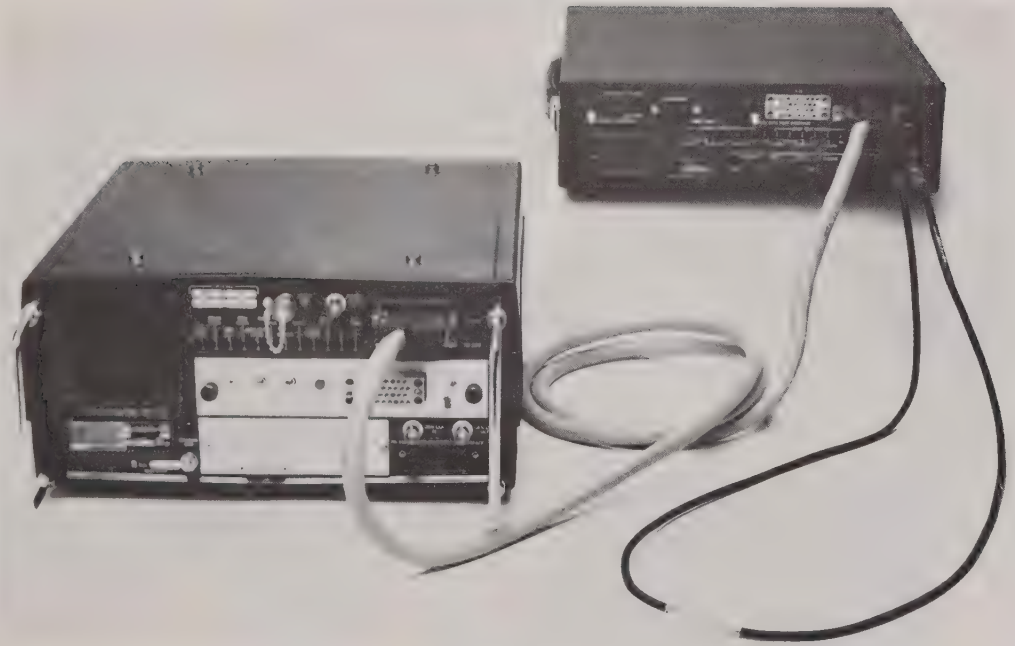

Figure A-5
Cable Connection
DSU Data Port RS-232 Operation

(6) Step the DATA RATE switch through each position, pausing to restart the FIREBERD and verify that the FIREBERD's SYNC indicator is illuminated and that no errors are accumulating.

(7) Disconnect the RS-232 cable from the Model 124.

A.2.6 VF Operation (Option)

If the optional 4-Wire VF Interface is not installed in your Model 124, skip this section.

A.2.6.1 Equipment Required

QUANTITY	DESCRIPTION	TTC PART NUMBER
3	310-to-310 Cable	10598 or 10420
1	Communications Analyzer	DATA SENTRY 10
1	VF Measurement Module	40340-01

A.2.6.2 Procedure

(1) Insert a VF Measurement Module into a DATA SENTRY 10. (Any VF test set can be used in place of the DATA SENTRY 10; refer to the DATA SENTRY 10 or specific test set operating manual for VF setup instructions.)

(2) Connect two WECO 310-to-310 connector cables between the DATA SENTRY 10 and the Model 124 for VF INPUT and VF OUTPUT (see Figure A-6).

(3) Connect the Model 124's INSERT T1 OUTPUT to the DROP T1 INPUT using the 310-to-310 cable.

(4) Ensure that DIP Switch 2 is in the 0,0 TLP (up) position on the rear panel of the Model 124.

(5) Set the Model 124's SIGNAL SOURCE switch to the 1004 Hz 0dBm0 position.

(6) Verify that the RCVR FREQ (Hz) on the DATA SENTRY 10 reads 1004 Hz.

(7) Slide the Model 124's VOLUME control to the right and verify that the tone is audible.

(8) Set the Model 124's SIGNAL SOURCE switch to the VF position.

(9) Set the DATA SENTRY 10 to transmit a frequency of 1000 Hz at +0.0 dBm, and verify that the RCVR FREQ (Hz) reads 1000 Hz and that the received signal level is 0.0 ±0.3 dBm.

(10) Set the transmit level to +3.0 dBm, and verify that the receive signal level is +3.0 ±0.3 dBm.

(11) Change the transmit level to -16.0 dBm.

(12) On the rear panel of the Model 124, set DIP Switch 2 to the +7, -16 TLP (down) position.

(13) The received signal level should display +7.0 ±0.3 dBm.

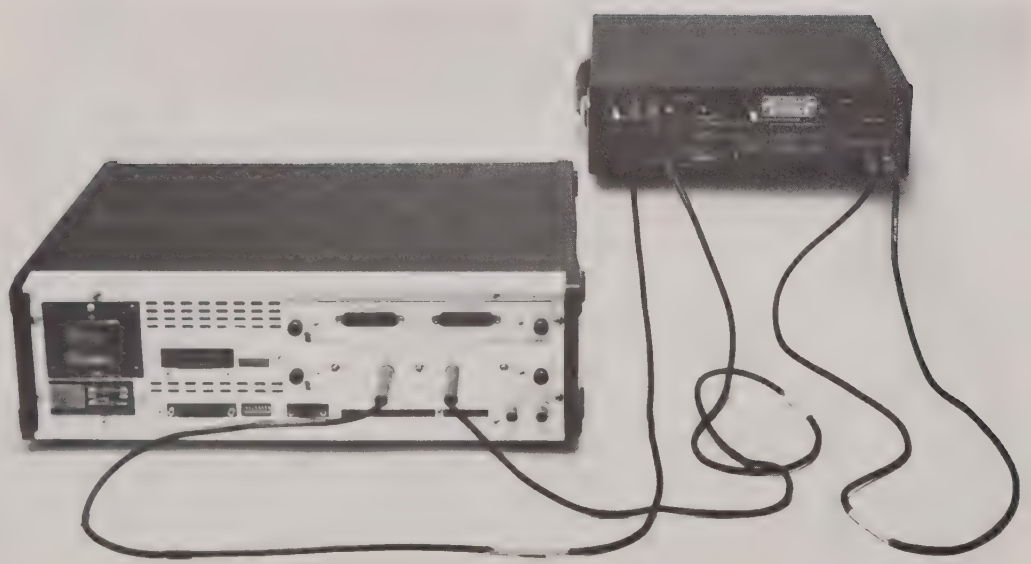

Figure A-6
Cable Connection – VF Operation

APPENDIX B
DSU DATA PORT DS0A FORMAT

The following section provides information on converting DSU Data Port serial data into DS0A formatted data.

B.1 DSU DATA PORT

The DSU Data Port converts serial data into DS0A formatted data. The DS0A format varies with data rate as shown in Table B-1. When the selected data rate is 56 kb/s, a "one" is added to each group of seven customer data bits to create a DS0A byte (56 kb/s x 8/7 = 64 kb/s). When the data rate is a subrate (2.4, 4.8, or 9.6 kb/s), two "ones" are added to each group of six customer data bits to create a byte. Each byte is then repeated 5, 10, or 20 times (for 9.6, 4.8, or 2.4 kb/s, respectively) to create a DS0A channel. (For example, 2.4 kb/s x 8/6 x 20 = 64 kb/s).

While dropping a DS0A formatted channel the DSU Data Port receiver selects only one byte out of each group of repeated words and ignores the remaining identical bytes. Note that the bytes are formed arbitrarily without regard to any word or block boundaries.

Table B-1
DS0A Byte Format

	2.4, 4.8, 9.6 kb/s	56 kb/s
	bl b8	bl b8
customer data	1 x x x x x x 1	x x x x x x x 1

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